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XC-142 VUGHT TRANSPORT

**NO. 3 SEMI-ANNUAL REPORT**

JANUARY THRU JUNE 1963  
CONTRACT NO. AF33(657)-7868

DDC

6/18 FEB 13 1964

CHANCE VOUGHT CORP.

A DIVISION OF LING-TEMCO-VOUGHT, INC.

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⑥ XC-142A

VTOL TRANSPORT PROGRAM

CONTRACT NO. AF33(657)-7868

⑦ Semi-annual rpt 1-3 JAN-JUN 63.

AERONAUTICS AND MISSILES DIVISION

CHANCE VOUGHT CORP.

  
L. C. Josephs  
Program Director, VTOL

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## INTRODUCTION

This report has been prepared in accordance with the requirements of Item 7 of Contract No. AF33(657)-7868 and is the third in a series of semi-annual reports covering activity in the XC-142A VTOL Transport Aircraft Program. This report is devoted specifically to a summary of progress for the period January through June 1963.

*Progress on the*

SUMMARY

*The overall XC-142A program is reported to be one week behind schedule at the end of the reporting period, January through June, 1963.* A significant major milestone was achieved during the period with the completion of the basic design effort in June. Numerous test programs were initiated and some completed, including the basic wind tunnel tests of the 0.110 scale model and the control system bearing wear tests. Design and fabrication of the flight control simulator continued with fabrication of the structure approximately 90% complete at the end of the reporting period. Construction work on the propulsion integrated test stand was completed. All open items from the full-scale mockup in July 1962 were completed. Airplane weight continued to grow during the six months period and a minimum weight control program was placed in effect by agreement with ASD in May.

The tooling effort reached its peak at the end of June with approximately 72 <sup>of</sup> percent of the overall tooling task having been completed. Effort began in the sub-assembly phase of the upper and lower mid-section. The 150-hour qualification test of the T-64 engine was completed by General Electric and the first production engine delivered to Hamilton Standard for use in engine and integral gearcase tests. A spares provisioning conference was held at the Contractor's facility in January as well as a formal AGE provisioning conference in April. The XC-142A PERT program was converted to the newly developed AFSC PERT III Routine in May allowing greater flexibility and more efficient operation.

A Management Group Conference was held at ASD in February to review

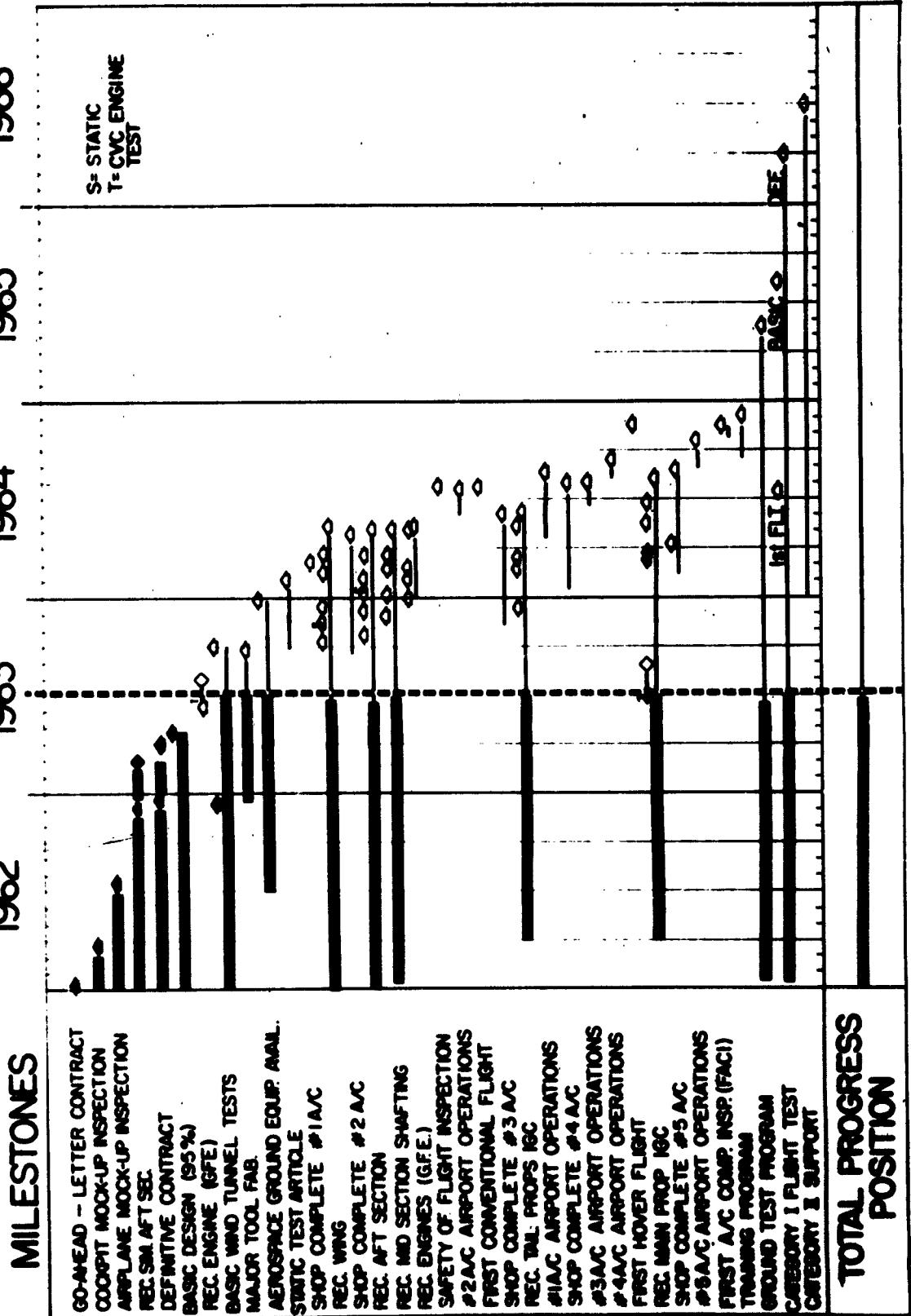
program status. The results of the review indicated a need for program reorientation with a subsequent submittal to ASD in February by the Contractor of a rescheduled first flight date from March to June, 1964. In addition to the scheduling problem existing on the program, projected expenditures indicated that it would be highly improbable that the program objectives could be attained within the existing funding envelope. Consequently, a list of those items that could be reduced in scope or completely eliminated without introducing a high degree of risk into the program was submitted to ASD in February. As the result of this scheduling and funding condition existing on the XC-142A program, an ASD Survey Team visited Chance Vought Corp. and Ryan Aeronautical Company in March. Based on recommendations of the survey team and ways and means of effecting cost reductions suggested by the Contractor, direction was received from ASD in March to place in a stop-work status various elements of the program and to work to a relaxed schedule to insure that expenditures would not exceed the fiscal year 1963 funding limitation. This resulted in a further slide of the first flight date to July, 1964. The definitized contract for the XC-142A program was executed in April and Contract Change Notice #5 was received in June authorizing the incorporation of ECP's 4 through 9 to effect cost savings on the program.

XC-142A  
1963  
BASE LINE DATE APRIL

BAASKE ET AL. 1383



# PROGRAM MASTER PLAN



ITEM 1.A

DEVELOPMENT OF XC-142 AND FABRICATION OF FIVE PROTO-TYPE MODELS

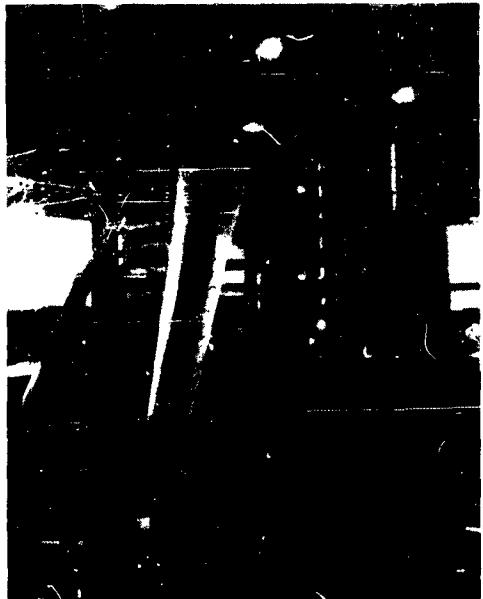
1.A.1

ACCOMPLISHMENTS

The tooling effort on the nose section, mid-section, final assembly line joining jigs and test and checkout equipment progressed well to schedule during the reporting period and was estimated to be 65 percent complete on this portion of the task. At the end of June, approximately 17,300 parts had been released for fabrication with 10,900 tools ordered for fabrication of these parts. Fabrication of detail parts began during the period and effort commenced in the subassembly phase of the upper and lower mid-sections. The fabrication effort was estimated to be 21 percent complete at the end of June 1963. Processing of procurement specifications was virtually completed and 97 percent of the castings and forgings had been placed on order.

The flap and aileron assembly tool designs were completed during the reporting period with tool fabrication approximately 80 percent complete and sheet metal details 75 percent complete at the end of June. Tool fabrication on the tri-directional and pivot gearcases and shafting was completed.

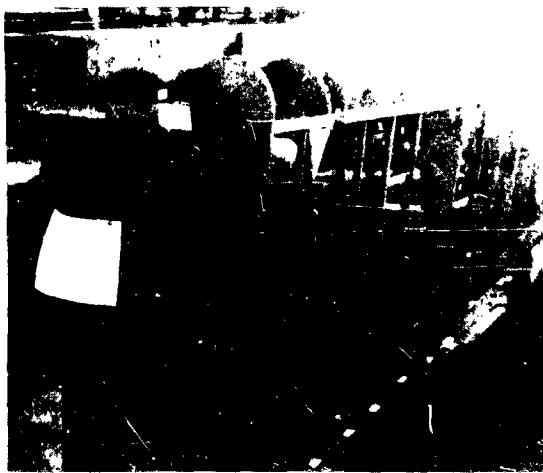
Tooling effort associated with the fabrication of the wing, nacelles, aft section and empennage reached its peak during the period with tool planning and design activity essentially complete at the end of June. Detail part completions accelerated to a level of 800 per week at the end of June with approximately 70% of the detail parts fabrication having been completed. The tail boom for number 1 airplane was completed and the assembly of the other major components of the aft section and empennage started.



UPPER CARGO DOOR



CARGO RAMP



RUDDER



LEADING EDGE OF  
VERTICAL STABILIZER

### 1.A.2

#### PROBLEM AREAS

During the reporting period several significant problems arose in the development and fabrication of the five prototype vehicles which were discussed in the monthly progress reports. Solutions were effected for the majority of the problems; however a few remain unresolved. A brief summary of the more significant problem areas follows:

##### 1.A.2.1

Aircraft Finish - A complex paint specification called for three types of paint on the same part which could result in significant tooling and manufacturing cost and schedule delay. This problem was resolved by agreement with ASD on a deviation from the MIL spec requirements.

##### 1.A.2.2

Longitudinal Feel and Trim Package - Long procurement lead time associated with portions of this system generated a problem during the reporting period. Availability was anticipated to be five weeks late to schedule, which would reduce the time span allowed in the schedule between clearance for first flight and actual flight set aside for incorporation of possible changes resulting from flight control simulator tests. Although considerable improvement in the procurement of this system was realized during June, anticipated deliveries remained marginal. A simulated package was being fabricated by the Contractor at the end of the reporting period in order to satisfy the mockup requirement at Ryan.

##### 1.A.2.3

Flap Actuating System - Difficulty was encountered during the period in locating a fabrication source for the ball spline universal joints required for this system. Consequently, significant delay in availability of the system was being predicted. During May, the possibility of eliminating all or part of the ball spline requirement was investigated and a stress analysis was conducted to determine gearcase modifications

that might be required by utilizing straight splines in place of ball splines. A decision was made to utilize straight splines in lieu of ball splines, eliminating the long procurement lead time for the ball splines. This necessitated the installation of new bearings in the gearcases, which resulted in a schedule delay condition. However, by utilization of gearcases with original bearings where necessary and replacement later in the program, it was not expected that shop completions or flights would be affected.

1.A.2.4                    Castings - Porosity problems on two tri-directional and pivot gearcase housing castings developed after completion of machining. Various solutions were explored and at the end of June it was believed that a method of producing acceptable castings had been developed. The test article requirements have been fulfilled by using salvage castings and metallurgical personnel are monitoring closely to insure program compatibility.

1.A.2.5                    Flaps and Ailerons - The flap and aileron assemblies were approximately four weeks behind schedule at the end of June primarily due to late receipt of major fairing tools from the tooling vendor and a mis-application of templates in establishing the position of jig locators during tool fabrication. Specialists in fixture fabrication and tool inspection along with appropriate management personnel from both CVC and Hiller were working jointly at the end of June to determine the means of achieving recovery. It is not expected that this behind schedule condition will affect the first flight date.

1.A.2.6                    Wing Shafting - As the result of completion of wing shafting deflection analysis during June a redesign of the wing shafting

flexible couplings was required which affects shafting deliveries to Ryan. However, it is currently planned that a facsimile will be provided by Hiller in order to accomplish clearance checks at Ryan. The production shafting will be installed at Chance Vought as had been planned. In addition, it appears that the stiffness of the main IGC's is too low at the point where the wing shaft connects, resulting in too low a shaft critical speed. Investigations by Hamilton Standard, Hiller and Chance Vought were being conducted at the end of June.

ITEM 1.B

FABRICATION OF STATIC TEST ARTICLE

Detail parts and subassemblies required for the static test article were in fabrication during the setup for fabrication of parts for the first two airplanes. Major line effort for the static test article was scheduled to the latter part of August upon completion of the first aircraft through the common major fixtures.

ITEM 2

FABRICATION OF MOCKUP

All follow-up action resulting from the full scale airplane evaluation held in July 1962 was completed during the reporting period. During January, AGF personnel visited the Contractor's plant to review a revised windshield arrangement incorporated on the airplane mockup as the result of higher than anticipated aerodynamic loads over the windshield revealed during the wind tunnel tests. The change consisted of increasing glass thickness and dividing the vertical panels into two panels, upper and lower, separated and reinforced by a horizontal cross member. Approval of this arrangement was obtained from AGF during the reporting period.

ITEM 3

GROUND TEST PROGRAM

During the reporting period engineering emphasis gradually shifted from design to the test programs. Essentially all testing was of the development type in preparation for component qualification testing which will progressively increase during the next period.

Basic wind tunnel tests using the 0.110 scale model were completed on 5 January. An .09 scale flutter model was completed in April and subjected to flutter tests in the low speed wind tunnel. Early during the test program a static failure occurred at the front spar of the model wing causing structural damage to the wing. The wing has since been repaired and tests are scheduled to resume in late July. A meeting was held at ASD on 15 and 16 May to review all available XC-142A wind tunnel data including that of Ames, Langley, and Princeton. The meeting highlighted several areas where airplane characteristics had not been consistently demonstrated in all tunnels. These three areas are: rate of descent capability, ground effects, and low directional stability and rudder effectiveness in low speed wing down flight. Programs concerning these areas were being formulated for review by ASD at the end of June. The CVAM 0.110 scale model was reworked to incorporate the tilted inboard nacelles plus several other refinements in preparation for further tests in August to confirm rate of descent capability. Preparations were being made to conduct ground effect tests using the Princeton model in the Princeton Forward Flight Facility. These are tentatively planned for September 1963. Plans are also being made to conduct directional stability tests at Langley using the Langley 0.110 scale model.

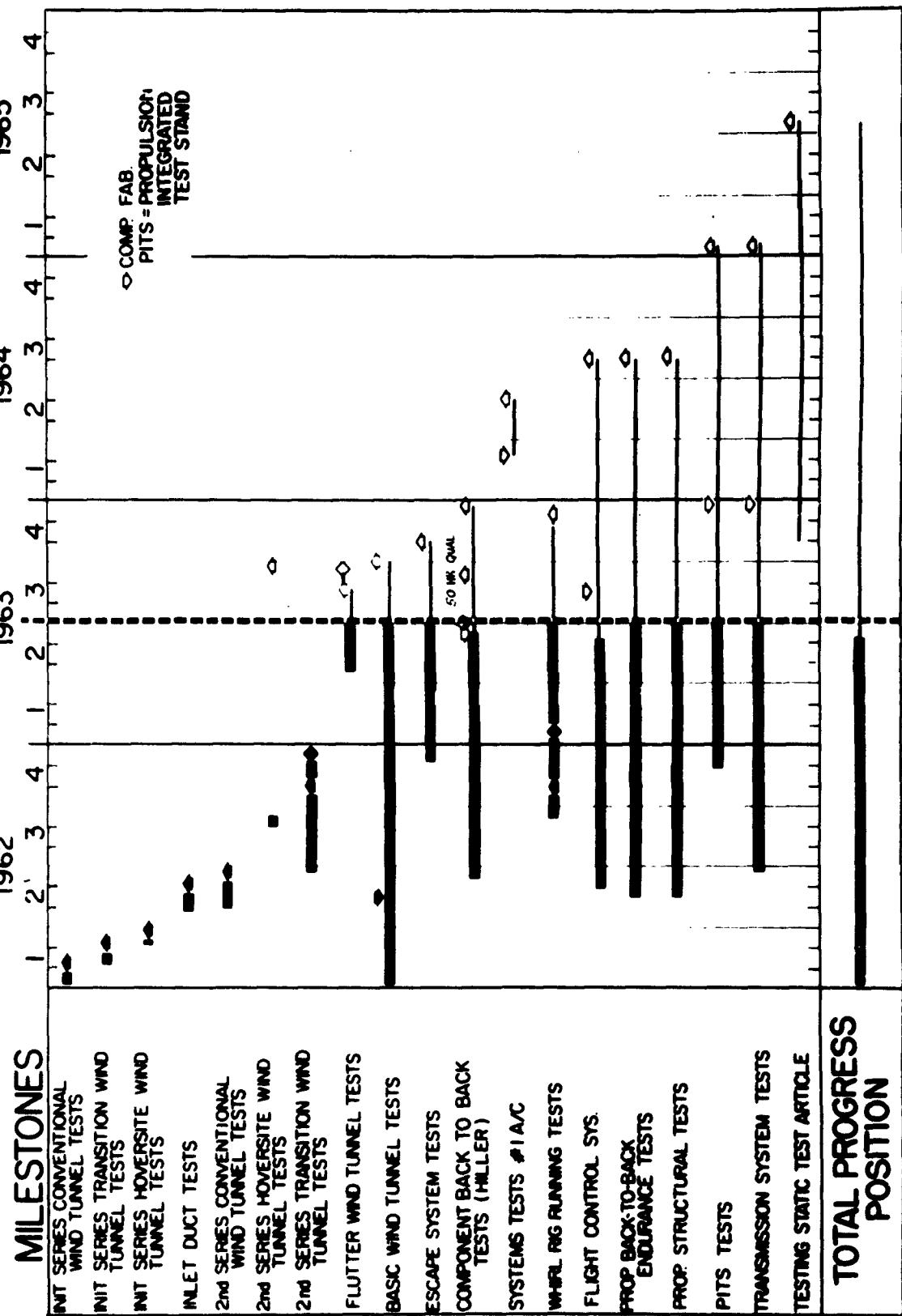


# XC-142A

## GROUND TEST MASTER PLAN

BASE LINE DATE APRIL 1963

### MILESTONES



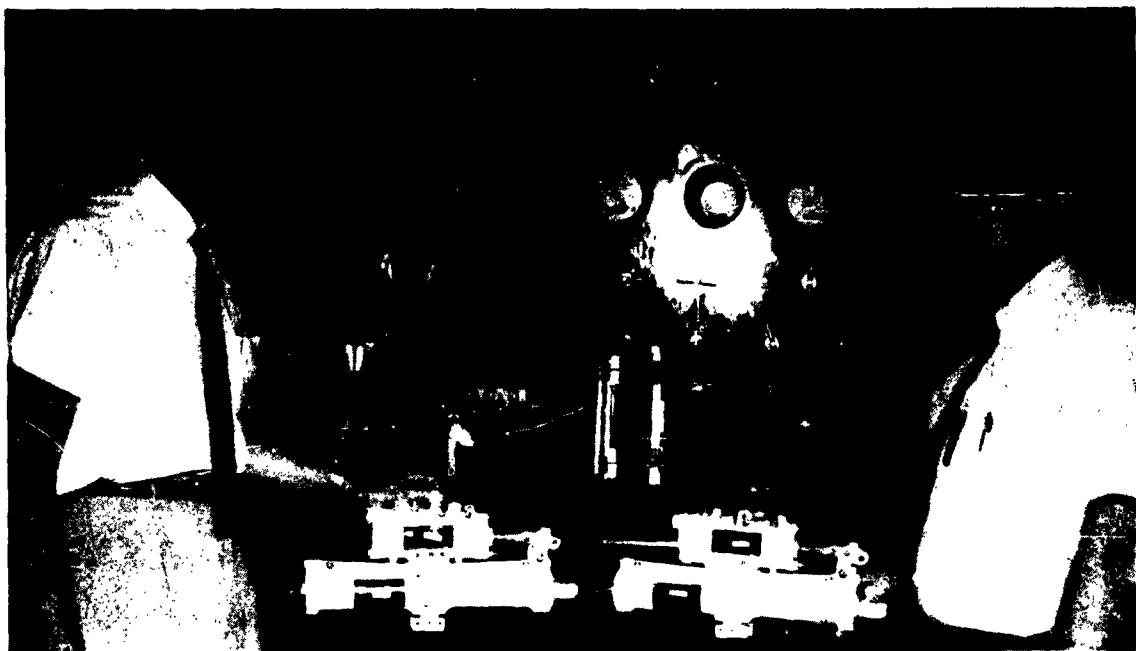
As in the design phase of the program, considerable effort was expended in determining areas of cost savings in the test programs. As a result, savings were made through the elimination of fatigue tests, the reduction in tests of the integral gearcases and reduction in structural testing.

Testing during the reporting period consisted primarily of design information tests. Set-up of the wing actuator gimbal fatigue test was essentially completed with tests scheduled to begin in July.

Control system bearing wear tests were successfully completed. Transmission system bearing and shafting tests were initiated and are continuing. Tests of the aileron, UHT, rudder, propeller pitch, and governor servo jigs were initiated and are continuing.

Design and fabrication of the flight control simulator continued. Control system installation design was essentially complete. Fabrication of the structure was approximately 90% complete and system components were being fabricated. The schedule status at the end of June indicated that the airplane control system clearance for first flight will be achieved approximately eight weeks prior to first flight.

Preparations were in effect to begin back-to-back tests of the integral gearcases in August. Pre-flight rating (Hill Top) tests of the tail propeller integral gearcase are scheduled to begin in August followed by pre-flight rating tests of the combined engine and main propeller gearcases. The T-64 engine for conducting these tests was delivered to Hamilton Standard in late June. CVAM combined engine gearbox and engine control system tests are scheduled to begin in September. The test site construction for the



AILERON POWER CONTROL CYLINDERS AFTER COMPLETION OF BENCH TEST



TRI-DIRECTIONAL GEARCASE TEST

Propulsion Integrated Test Stand (PITS) was completed and parts were in fabrication at the conclusion of the reporting period.

Tail propeller whirl tests were completed in May and main propeller whirl tests are scheduled to begin in August.

ITEM 4

ENGINEERING DATA

4.1

ACCOMPLISHMENTS

A major portion of the engineering effort during the reporting period continued to be devoted to the release of basic design for tests and production. The engineering program schedule was realigned in February 1963 consistent with the program reorientation as discussed during the Management Group meeting at ASD on 6 and 7 February and as recommended in the Contractor's letter to ASD on 25 February. Ninety-five percent basic design completion was rescheduled from March to April 1963. Engineering manpower loadings were adjusted consistent with the revised schedule and special studies were initiated to determine areas of cost reduction. In March, as a result of these studies, ASD issued directives to stop work on the following: (1) inflight load survey, (2) sled tests, (3) ferry tank, (4) four of the five sets of troop seats, and (5) wing fatigue tests. ECPs were established to cover deletion of these items of the program. ASD also issued a CCN in May covering reduction in the scope of testing required for integral gearcases.

The 95% completion point was reached on all structural design at Chance Vought and Hiller in April and at Ryan in May. Final releases of the system design were completed in June.

By the close of the reporting period engineering emphasis had shifted from basic design to the test programs and support of the manufacturing effort. At the same time, a concerted effort was centered around the preparation and accumulation of design data for submittal to ASD. Particular emphasis was put on submission of surveillance item data.

The basic configuration of the airplane remained unchanged during the reporting period although a number of alterations were incorporated. Most significant of these were redesign of the windshield, replacement of the LW-2 ejection seat with the A4D seat and elimination of the ferry fuel tank. A number of refinements were incorporated into the control system and transmission system. Change in the windshield consisted of increasing the glass thickness and the addition of a horizontal windshield framing member, as determined on the basis of wind tunnel tests (see ITEM 2). Considerable discussion and study was conducted relative to increasing the primary generator capacity from 25 KVA to 35 KVA; however, the 25 KVA system was finally selected.

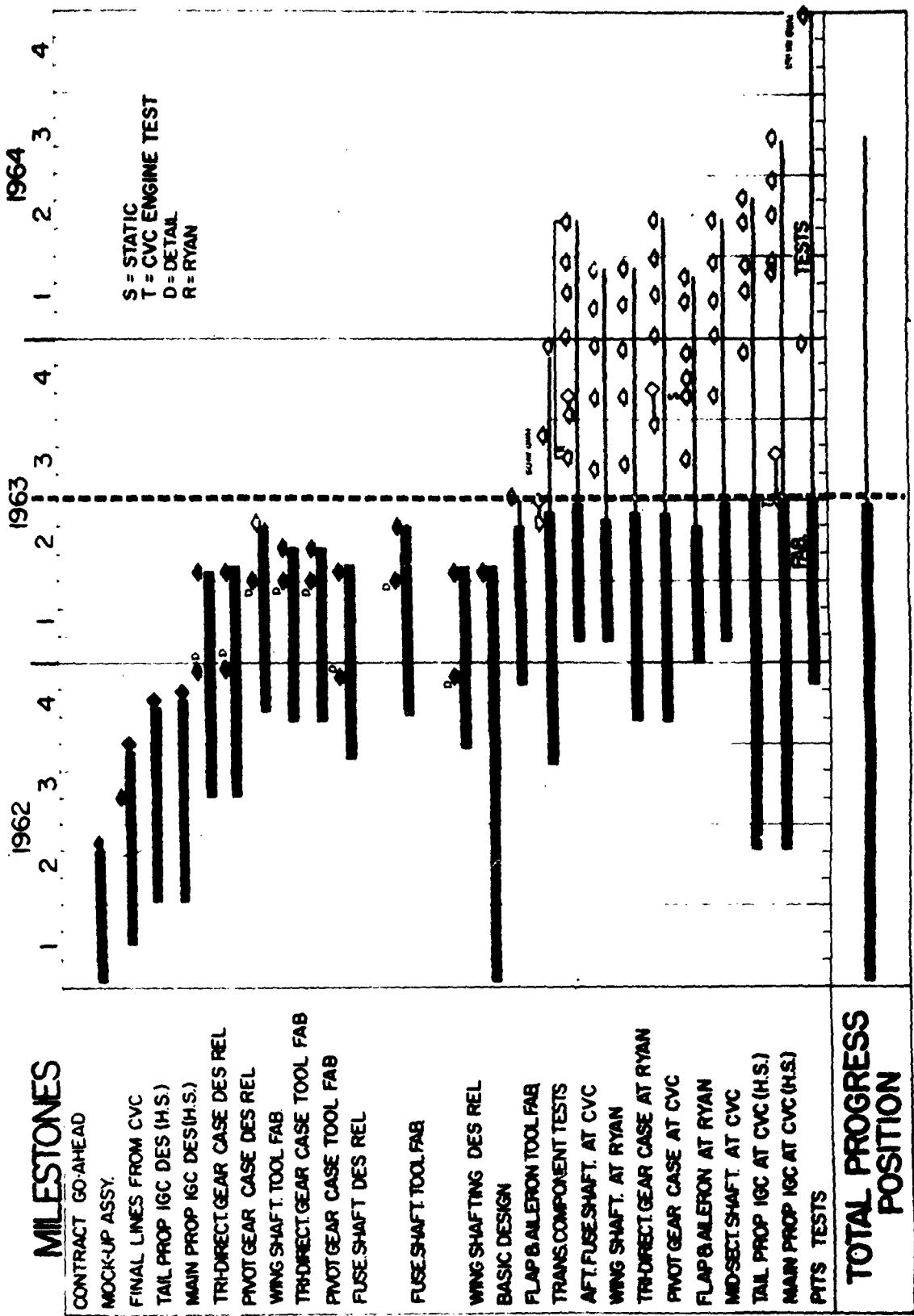
Several problems associated with the power train were investigated and resolved. An over-thrust condition of the tail propeller and its drive system was found to exist while operating during transient conditions on a cold day. It was concluded that the components in question could be operated intermittently at a high enough load level to provide adequate airplane control and trim. Plans for verification were in process. In May, an investigation was conducted into the problem of high axial loads being transmitted from the engine torque shaft into the input shaft of the main integral gearcase. This was corrected by a change to the aft bearing of the integral gearcase.

XC-42A

BASE LINE DATE APRIL 1963



# HILLER MASTER PLAN



A detailed analysis in May of the basic airframe and transmission deflection criteria indicated that wing cross-shaft deflections were in excess of values used for detail design of the flexible couplings. In addition, dynamic analyses of cross-shaft natural frequencies indicated that the shaft critical speed was not as far above operating speed as desired. This problem was corrected by modifying and relocating the ball splines on the shaft. Further detail dynamic studies of the transmission system were planned at the end of June.

The Contractor focused considerable emphasis on the control system design. The many variables associated with the airplane and system concept required considerable study to minimize complexity and provide maximum effectiveness. The basic control system concept remained unchanged although numerous refinements were incorporated. Final drawings of the system were released in June.

Special efforts were devoted to correcting an increasing weight trend which became apparent early in 1963. At the request of ASD, the Contractor forwarded a letter which summarized the weight control effort to date and recommended a minimum weight control implementation be pursued during the remainder of the program to minimize cost. ASD concurred with the recommendation and requested an ECP reflecting the new weight control policy. In the meantime, efforts were in effect to incorporate approximately 80 pounds of weight reduction. At the end of the reporting period the aircraft weight was 334 pounds over the model specification guarantee.

Procurement specifications for all but a few items of equipment were completed and released by engineering. Vendor selection was complete on the majority of items. Acceptance and operational test specifica-

tions and test plans were in work at the close of the reporting period.

ITEM 5

TECHNICAL DATA

The Ground Test Program Outline Report was submitted to ASD in January incorporating changes requested. It was resubmitted for approval in March after further agreement on desirable changes. Complete concurrence with the report by ASD was withheld pending resolution of certain test areas, i.e., landing gear tests. Revisions to the Detail Specification and Design Data document as requested by ASD were prepared during March and submitted in April. The Ground Test Program Outline Report, Detail Specification and Design Data Document were approved by virtue of the definitized contract in April. However, revisions will continue to be made to these documents as required throughout the program. Specification Change Notices covering the cost reduction ECP's were submitted in May. Revised System Summary Reports were in preparation during June for submittal during the period June-August 1963. A Design Data Check-off List was developed in the format requested by ASD and submitted for approval in June. The report will be revised and up-dated periodically to provide an accurate and ready record of documentation submissions.

ITEM 6

FLIGHT TEST AND DEMONSTRATION

Work in the flight test area during the reporting period consisted primarily of the preparation and release of instrumentation installations and general planning. Instrumentation design for number 1 airplane was completed in June and is continuing for number 2 and 3 airplanes. Requirements for purchased equipment for airplanes 1, 2 and 3 were released for procurement.

ITEM 7

REPORTS

Monthly progress reports were submitted to ASD each month during the reporting period and with definitization of the contract became due the twentieth of the month for the previous month's activities. PERT reports were submitted each month, due the fifth working day, giving program schedule status and critical path analysis.

ITEM 8

SPARE PARTS FOR FIVE PROTOTYPE AIRPLANES

A spares provisioning conference was held at Chance Vought in January with representatives of ASD, WRAMA and EAFB in attendance. Agreement was reached with ASD in February wherein the Contractor would have the responsibility of administering the spares program with the advice and recommendations of the Systems Project Office. Consequently, it was agreed that formal submittals of spares items on an individual basis would not be required. As a part of the overall cost savings program, an internal re-provisioning conference was held at the Contractor's facility in March to determine the minimum requirement for spare items.

ITEM 9

DEVELOPMENT AND FABRICATION OF AGE

Processing of Aerospace Ground Equipment Recommendation Data (AGERDs) continued during the reporting period. Through June, a total of 75 AGERDs had been submitted to ASD of which 48 were for CFE items and 27 GFE items. At the end of June, ASD had approved 50 of the items. It is anticipated that 39 new items will be submitted in the near future as the result of Hiller and Hamilton Standard requirements. A formal AGE provisioning conference was held at Chance Vought in April with representatives

from ASD, EAFB and WRAMA in attendance. In addition, a meeting was held in April among Vought, Hiller and Hamilton Standard on the transmission system AGE requirements and AGERD status.

A meeting was held at ASD in May to discuss various aspects of the AGE program including approaches to resolve problem areas. Items discussed included the difficulties experienced by the Contractor in obtaining necessary engineering data for evaluation of ASD recommended substitutes for government furnished AGE. A proposal for all GFE support items required for the compliance specification tests, aircraft production and acceptance flights that ASD has been unable to locate in the supply system was submitted to ASD in June.

ITEM 10 SPARE PARTS FOR AGE

The spares provisioning conferences conducted at Chance Vought in January and March included spare parts consideration for AGE as well as for the aircraft. No other significant activity occurred during the reporting period in this area except as reported under ITEM 8 of this report.

ITEM 11 TRAINING AND TRAINING EQUIPMENT

The initial preparation for XC-142A training courses was initiated in October 1962 and continued through March 1963. The majority of this preparation was completed, including the required training aids, by the start of the first series of contractor personnel courses in May. This series of classes, with the exception of the Flight Controls, Hydraulics, and Plane Captain courses, was completed during June. The courses listed above were

delayed to allow recent system changes to be incorporated into the course content. A complete series of courses for contractor personnel will be offered beginning in August.

ITEM 12

CONTRACTOR SUPPORT OF CATEGORIES I AND II FLIGHT TEST PROGRAM

The initial provisioning of spare parts to support the Category I and II flight test programs was accomplished during the reporting period. This provisioning was approximately 80% complete at the end of June, with the only major item still to be provisioned being the "bits and pieces" needed for overhaul and repair of the transmission system components. It is expected that the provisioning of these parts will be accomplished shortly. Engine and gearbox utilization schedules were prepared during the period. Revisions to these schedules, reflecting minor changes to the test schedule, were forwarded to ASD. While no Support Guidance Conferences have been held at this time, the first such conference is planned for August 1963.

ECP INDEX

<u>ECP No.</u>	<u>TITLE</u>	<u>STATUS</u>
1	Fuselage, Installation of Aft Fuselage Escape Doors	Disapproved
2	Electrical, Installation of 35 KVA Generators	Disapproved
3	Electronics, Additional AT-256A/ARC UHF Communications Antenna - Installation of	Disapproved
4	Flight Tests, Category I In-Flight Load Survey - Elimination of	Authorized
5	Ground Tests, Escape System Sled Test - Elimination of	Authorized
6	Fuel System, Ferry Fuel Tank - Elimination of	Authorized
7	Escape System, Douglas Escapac 1-C Ejection Seat in Lieu of LW-1 (modified) Seat - Installation of	Authorized
8	Furnishings - Cargo, Troop Accessories for 4 Airplanes - Elimination of	Authorized
9	Ground Test, Wing Fatigue Test - Elimination of	Authorized
10	Structural Demonstrator Instrumentation - Addition of	Pending
11	Ground Test, Structural Failing Load Test - Elimination of	Pending
12	Navigation Equipment, AN/ARC-21C in lieu of AN/ARN-52(V) - Provisions for	Pending
13	Propulsion System, Integral Gear Box Propeller System Test - Reduction of	Pending
14	Drawing Quality Requirements - Reduction of	Pending
15	Weight Control Policy - Revision of	Pending
16	Main Propeller IGC Bearing Change	Pending

CCN INDEX

<u>CCN No.</u>	<u>TITLE</u>	<u>DATE</u>
1	Substitute 35 KVA Generator For 25 KVA Generator	12-19-62
2	Reduction In Data Requirements	4-26-63
3	Substitute 25 KVA Generator For 35 KVA Generator	2-4-63
4	Reduction In IGB Propeller Testing	5-3-63
5	Approval of ECPs 4 - 9	6-5-63